

HW02

AUTHOR

Shijie An

Homework 2

```
library(leaps)
library(caret)
```

Loading required package: ggplot2

Loading required package: lattice

```
library(tidyverse)
```

— Attaching packages

tidyverse 1.3.2 —

✓ tibble 3.1.8 ✓ dplyr 1.0.10
✓ tidyr 1.2.1 ✓ stringr 1.4.1
✓ readr 2.1.2 ✓ forcats 0.5.2
✓ purrr 0.3.4

— Conflicts ————— tidyverse_conflicts() —

✗ dplyr::filter() masks stats::filter()
✗ dplyr::lag() masks stats::lag()
✗ purrr::lift() masks caret::lift()

```
library(lars)
```

Loaded lars 1.3

```
library(ISLR2)
library(gam)
```

Loading required package: splines

Loading required package: foreach

Attaching package: 'foreach'

The following objects are masked from 'package:purrr':

accumulate, when

Loaded gam 1.20.2

1. Load the College.csv file on Canvas into a dataframe called college (or give it any name you want). A description of the dataset can be found at
<https://www.rdocumentation.org/packages/ISLR2/versions/1.3-1/topics/College>

```
college <- read.csv("College.csv")
```

2. Check if there are any missing values. Replace any missing values with the mean value for the column rounded up to the nearest integer. Hint: Lookup the ceiling function and use it.

```
missing <- which(is.na(college))
missingCol <- floor(missing / nrow(college)) + 1
missingCol
```

```
[1] 14 14 14 19 19
```

```
college$PhD[is.na(college$PhD)] <- ceiling(mean(college$PhD, na.rm = TRUE))
college$Grad.Rate[is.na(college$Grad.Rate)] <- ceiling(
  mean(college$Grad.Rate, na.rm = TRUE))
```

3. Remove the college name column from the dataframe as it is not useful in prediction

```
college <- college[, -1]
colnames(college)
```

```
[1] "Private"      "Apps"        "Accept"       "Enroll"       "Top10perc"
[6] "Top25perc"    "F.Undergrad"  "P.Undergrad"  "Outstate"     "Room.Board"
[11] "Books"        "Personal"     "PhD"          "Terminal"     "S.F.Ratio"
[16] "perc.alumni"  "Expend"      "Grad.Rate"
```

4. Split the dataset into 80% training and 20% test.

```
intrain <- createDataPartition(college$Top10perc, p = 0.8, list = FALSE)
train1 <- college[intrain, ]
test1 <- college[-intrain, ]
```

5. Fit a linear multiple regression model to the training set to predict graduation rate using all the other features/variables. What variables are significant at the $p = 0.001$ level? Predict the graduation rate using the test dataset and report the root mean squared error (RMSE) for the test dataset.

```
reg_model <- train(Grad.Rate ~ ., data = train1, method = "lm")
summary(reg_model)
```

Call:

```
lm(formula = .outcome ~ ., data = dat)
```

Residuals:

	Min	1Q	Median	3Q	Max
	-53.548	-7.147	-0.404	6.975	49.362

Coefficients:

	Estimate	Std. Error	t value	Pr(> t)
(Intercept)	32.8706293	5.3406512	6.155	1.37e-09 ***
PrivateYes	4.1184526	1.8330915	2.247	0.025017 *
Apps	0.0014330	0.0004952	2.894	0.003947 **
Accept	-0.0010398	0.0009859	-1.055	0.291991
Enroll	0.0013598	0.0024086	0.565	0.572577
Top10perc	0.0285367	0.0797002	0.358	0.720431
Top25perc	0.1569323	0.0615656	2.549	0.011048 *
F.Undergrad	-0.0002604	0.0004157	-0.627	0.531169
P.Undergrad	-0.0014725	0.0004055	-3.632	0.000306 ***
Outstate	0.0011538	0.0002655	4.346	1.62e-05 ***
Room.Board	0.0015543	0.0006701	2.320	0.020698 *
Books	-0.0012446	0.0031022	-0.401	0.688408
Personal	-0.0015809	0.0008847	-1.787	0.074448 .
PhD	0.1504330	0.0624201	2.410	0.016249 *
Terminal	-0.1570464	0.0690811	-2.273	0.023354 *
S.F.Ratio	0.1787299	0.1829464	0.977	0.328983
perc.alumni	0.2906975	0.0558560	5.204	2.67e-07 ***
Expend	-0.0004651	0.0001683	-2.764	0.005886 **

Signif. codes: 0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1				

Residual standard error: 12.7 on 605 degrees of freedom

Multiple R-squared: 0.4724, Adjusted R-squared: 0.4576

F-statistic: 31.87 on 17 and 605 DF, p-value: < 2.2e-16

```
# testprediction1 <- predict(reg_model, newdata = train1, method = "Lm")
# postResample(pred = testprediction1, obs = train1$Grad.Rate)
## I used top10perc as a dataset to split, and got a R-squared = 0.4515 and RSE = 13.01 on 605 de
testpredictions <- predict(reg_model, newdata = test1, method = "lm")
postResample(pred = testpredictions, obs = test1$Grad.Rate)
```

RMSE	Rsquared	MAE
13.1853090	0.3900248	10.0148954

```
## the rest root mean squared error (RMSE) is 12.4563567
```

6. Perform backward subset selection using the leaps library. Which model is best according to BIC? Are the variables chosen by the subset selection different from the list of statistically significant variables from fitting the linear regression model above? If so, which ones are different?

```
regfit_bwd <- regsubsets(Grad.Rate ~ ., data = train1, nvmax = 18, method = "backward")
reg_summary <- summary(regfit_bwd)
reg_summary
```

Subset selection object

Call: regsubsets.formula(Grad.Rate ~ ., data = train1, nvmax = 18,
method = "backward")

17 Variables (and intercept)

Forced in Forced out

	Forced in	Forced out
PrivateYes	FALSE	FALSE
Apps	FALSE	FALSE
Accept	FALSE	FALSE
Enroll	FALSE	FALSE
Top10perc	FALSE	FALSE
Top25perc	FALSE	FALSE
F.Undergrad	FALSE	FALSE
P.Undergrad	FALSE	FALSE
Outstate	FALSE	FALSE
Room.Board	FALSE	FALSE
Books	FALSE	FALSE
Personal	FALSE	FALSE
PhD	FALSE	FALSE
Terminal	FALSE	FALSE
S.F.Ratio	FALSE	FALSE
perc.alumni	FALSE	FALSE
Expend	FALSE	FALSE

1 subsets of each size up to 17

Selection Algorithm: backward

	PrivateYes	Apps	Accept	Enroll	Top10perc	Top25perc	F.Undergrad	P.Undergrad	Outstate	Room.Board	Books	Personal	PhD	Terminal	S.F.Ratio
1 (1)	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "	" "
2 (1)	" "	" "	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
3 (1)	" "	" "	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
4 (1)	" "	" "	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
5 (1)	" "	"*"	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
6 (1)	" "	"*"	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
7 (1)	" "	"*"	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
8 (1)	" "	"*"	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
9 (1)	" "	"*"	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
10 (1)	"*"	"*"	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
11 (1)	"*"	"*"	" "	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
12 (1)	"*"	"*"	"*"	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
13 (1)	"*"	"*"	"*"	" "	" "	" "	"*"	" "	" "	" "	" "	" "	" "	" "	" "
14 (1)	"*"	"*"	"*"	" "	" "	" "	"*"	"*"	" "	" "	" "	" "	" "	" "	" "
15 (1)	"*"	"*"	"*"	"*"	" "	" "	"*"	"*"	" "	" "	" "	" "	" "	" "	" "
16 (1)	"*"	"*"	"*"	"*"	"*"	" "	"*"	"*"	" "	" "	" "	" "	" "	" "	" "
17 (1)	"*"	"*"	"*"	"*"	"*"	"*"	"*"	"*"	" "	" "	" "	" "	" "	" "	" "

```

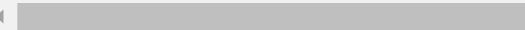
> \ +
4 ( 1 ) "*"   "*"   " "   " "   " "   " "   " "
5 ( 1 ) "*"   "*"   " "   " "   " "   " "   " "
6 ( 1 ) "*"   "*"   " "   " "   " "   " "   " "
7 ( 1 ) "*"   "*"   "*"   " "   " "   " "   " "
8 ( 1 ) "*"   "*"   "*"   " "   " "   " "   "*" "
9 ( 1 ) "*"   "*"   "*"   " "   " "   "*"   "*" "
10 ( 1 ) "*"  "*"   "*"   " "   " "   "*"   "*" "
11 ( 1 ) "*"  "*"   "*"   " "   "*"   "*"   "*" "
12 ( 1 ) "*"  "*"   "*"   " "   "*"   "*"   "*" "
13 ( 1 ) "*"  "*"   "*"   " "   "*"   "*"   "*" "
14 ( 1 ) "*"  "*"   "*"   " "   "*"   "*"   "*" "
15 ( 1 ) "*"  "*"   "*"   " "   "*"   "*"   "*" "
16 ( 1 ) "*"  "*"   "*"   " "   "*"   "*"   "*" "
17 ( 1 ) "*"  "*"   "*"   " "   "*"   "*"   "*" "
      perc.alumni Expend
1 ( 1 ) " "   " "
2 ( 1 ) " "   " "
3 ( 1 ) "*"   " "
4 ( 1 ) "*"   " "
5 ( 1 ) "*"   " "
6 ( 1 ) "*"   "*"
7 ( 1 ) "*"   "*"
8 ( 1 ) "*"   "*"
9 ( 1 ) "*"   "*"
10 ( 1 ) "*"  "*"
11 ( 1 ) "*"  "*"
12 ( 1 ) "*"  "*"
13 ( 1 ) "*"  "*"
14 ( 1 ) "*"  "*"
15 ( 1 ) "*"  "*"
16 ( 1 ) "*"  "*"
17 ( 1 ) "*"  "*"

```

```
which.min(reg_summary$bic)
```

```
[1] 7
```

```
## in the last problem, I got my statistically significant variables are Outstate and perc.alumni
```



7. Fit a ridge regression model on the training set for predicting graduation rate using all the predictors, with λ chosen by 5-fold repeated cross-validation with 5 repeats. Predict graduation rate using the test dataset and report the test root mean squared error (RMSE). Report the value of λ used in the model.

```
ridge_fit1 <- train(Grad.Rate ~ ., data = train1, method = "ridge",
                     preProcess = c("scale", "center"))
```

```
ridge fit1
```

```
localhost:5324
```

623 samples
17 predictor

Pre-processing: scaled (17), centered (17)
Resampling: Bootstrapped (25 reps)
Summary of sample sizes: 623, 623, 623, 623, 623, 623, ...
Resampling results across tuning parameters:

lambda	RMSE	Rsquared	MAE
0e+00	13.26651	0.4087495	9.913159
1e-04	13.26540	0.4088254	9.912524
1e-01	13.03396	0.4289179	9.785501

RMSE was used to select the optimal model using the smallest value.
The final value used for the model was lambda = 0.1.

the value of λ is best fit when $\lambda = 0.1$

8. Run the same ridge regression model above but this time use a grid of lamdas to search over.
Use a grid of 50 values ranging from $\lambda = 0.001$ to $\lambda = 10000$. Report the λ that was chosen.

```
ridge_grid <- data.frame(lambda = seq(0.001, 10000, length = 50))
ridgefit2 <- train(Grad.Rate ~ ., data = train1, method = "ridge",
                    tuneGrid = ridge_grid, preProcess = c("scale", "center"))
ridgefit2
```

Ridge Regression

623 samples
17 predictor

Pre-processing: scaled (17), centered (17)
Resampling: Bootstrapped (25 reps)
Summary of sample sizes: 623, 623, 623, 623, 623, 623, ...
Resampling results across tuning parameters:

lambda	RMSE	Rsquared	MAE
0.0010	13.25318	0.4070477	9.800318
204.0826	44.27854	0.3732784	34.682995
408.1642	44.76711	0.3730717	35.066214
612.2458	44.93275	0.3730025	35.196157
816.3274	45.01610	0.3729678	35.261531
1020.4091	45.06628	0.3729469	35.300884
1224.4907	45.09981	0.3729330	35.327173
1428.5723	45.12379	0.3729231	35.345978
1632.6539	45.14180	0.3729157	35.360096

1836.7355	45.15582	0.3729099	35.371086
2040.8171	45.16704	0.3729052	35.379885
2244.8987	45.17622	0.3729014	35.387089
2448.9803	45.18388	0.3728983	35.393094
2653.0620	45.19036	0.3728956	35.398178
2857.1436	45.19592	0.3728933	35.402536
3061.2252	45.20074	0.3728913	35.406314
3265.3068	45.20495	0.3728896	35.409621
3469.3884	45.20868	0.3728880	35.412539
3673.4700	45.21198	0.3728867	35.415134
3877.5516	45.21494	0.3728854	35.417455
4081.6332	45.21761	0.3728843	35.419545
4285.7149	45.22002	0.3728833	35.421436
4489.7965	45.22221	0.3728824	35.423156
4693.8781	45.22422	0.3728816	35.424726
4897.9597	45.22605	0.3728809	35.426165
5102.0413	45.22774	0.3728802	35.427489
5306.1229	45.22930	0.3728795	35.428712
5510.2045	45.23074	0.3728789	35.429844
5714.2861	45.23208	0.3728784	35.430895
5918.3678	45.23333	0.3728778	35.431874
6122.4494	45.23450	0.3728774	35.432787
6326.5310	45.23559	0.3728769	35.433642
6530.6126	45.23661	0.3728765	35.434443
6734.6942	45.23757	0.3728761	35.435196
6938.7758	45.23847	0.3728757	35.435905
7142.8574	45.23932	0.3728754	35.436573
7346.9390	45.24013	0.3728750	35.437204
7551.0207	45.24089	0.3728747	35.437801
7755.1023	45.24161	0.3728744	35.438366
7959.1839	45.24229	0.3728742	35.438903
8163.2655	45.24294	0.3728739	35.439412
8367.3471	45.24356	0.3728736	35.439897
8571.4287	45.24415	0.3728734	35.440359
8775.5103	45.24471	0.3728732	35.440799
8979.5919	45.24525	0.3728729	35.441220
9183.6736	45.24576	0.3728727	35.441621
9387.7552	45.24625	0.3728725	35.442005
9591.8368	45.24672	0.3728723	35.442373
9795.9184	45.24717	0.3728721	35.442726
10000.0000	45.24760	0.3728720	35.443064

RMSE was used to select the optimal model using the smallest value.
The final value used for the model was lambda = 0.001.

```
## Lambda was chosen to 0.001
```

9. Fit a Generalized Additive local regression (LOESS) model on the training set for predicting graduation rate using all the predictors. Do not specify a span so caret can choose a span.

Report the span chosen by caret. Predict graduation rate in the test dataset and report the test root mean squared error (RMSE).

```
loess_model <- train(Grad.Rate ~ ., data = train1, method = "gamLoess")  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
lowerlimit 0.685  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval  
25  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 29.65  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval  
24  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 29.65  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
96  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 95.47  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 8
```

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 9.535

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 2340

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 2009

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 120

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : lowerlimit 191

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 110

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : lowerlimit 191

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval 4913

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : upperlimit 4308.2

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval 20100

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : upperlimit 20052

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 12.565

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval
12

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 12.565

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
28.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 27.927

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval
250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 276.94

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
upperlimit 7377.9

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
7398  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 7377.9  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
7425  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 7377.9  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 6392  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 6210.7  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2613  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2580  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2613  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 15171
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval 31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : lowerlimit 0.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : upperlimit 63.31

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval 24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : lowerlimit 24.625
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
1  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1.53  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
1  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1.53  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
1  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1.53  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
1  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 8  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : lowerlimit 9.535  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 2340  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 2009.5  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 4913
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4219.8
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
4288
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4219.8
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
21836
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
10962
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2954.7
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2580
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2954.7
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2700  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2954.7  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 15171  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 20192  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 19972  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 48094  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 19972  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 103  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
upperlimit 100.46
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
28.8  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 27.925  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2.7755  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
250  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 377.44  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
300  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 377.44  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
300  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 377.44  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
350
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 377.44
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
300
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 377.44
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
300
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 377.44
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1780
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1848.8
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 6180
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 5902.1
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 6392
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 5902.1
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 63.315

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval
24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 24.625

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 10

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8
```

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
upperlimit 100.43

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 10

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 13.57

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 2340

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : upperlimit 2009.5

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
28.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 27.925

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 2.7755

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
21836  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 11017  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
lowerlimit 0.685  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval  
24  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 24.625  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
96  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 95.47  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 103  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
upperlimit 100.46  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
28.8  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 27.927  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1780  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1848.8  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2493.1  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
20100  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20051  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 15171  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 20192  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 19411
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 48094
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 19411
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 19873
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 19411
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
96
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 95.47
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2.7705
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
250
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 280.06
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
4913  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4307.9  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2613.7  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
20100  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20046  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2580  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2613.7  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval  
64  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
upperlimit 63.315
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval  
24  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 24.625  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
96  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 95.47  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
250  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 276.94  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 6392  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 6210.7  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
21836  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 11017  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2493.1  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
20100  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20051  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
31643  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 29082  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
30017  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 29082  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 56233  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 45915  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval  
64
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
upperlimit 63.315  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 8  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
lowerlimit 9.535  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 2340  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 2009.4  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 110  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : lowerlimit 110.6  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
96  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 95.47  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2.7705  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
4913  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4308.2  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
8124  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 7453.2  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
21836  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
10962  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 6180  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 5902.2  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 6392  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 5902.2
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
20100  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20048  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 15096  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 13309  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 13309  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 48094  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 20293  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
28938  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 27514  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
31643
```

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 27514

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval
30017

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
upperlimit 27514

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
63

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 60.295

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 0.705

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 60.295

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
lowerlimit 9.55  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 103  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
upperlimit 100.45  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 1495  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 1406.5  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 2000  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 1406.5  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 2340  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 1406.5  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
28.8  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 27.927  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval
64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 63.315

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.9

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7755

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
3.3

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7755

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 3.7755

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval
1880

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
lowerlimit 1889

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :
extrapolation not allowed with blending

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1780  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1889  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2492.4  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 56233  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 45914  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval  
24  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 24.625  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 10  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
lowerlimit 24.61  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  eval 8  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  lowerlimit 24.61  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  eval 14  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  lowerlimit 24.61  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  eval 16  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  lowerlimit 24.61  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  eval 10  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  lowerlimit 24.61  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
  96  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
  upperlimit 95.47  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
  0.5, : eval 2340  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
  0.5, : upperlimit 2009.5
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval 250

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : lowerlimit 276.94

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval 20100

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : upperlimit 20052

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : lowerlimit 0.685
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 103  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
upperlimit 100.46  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval  
9  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 11.56  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1780  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1848.8  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
21836  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
10962  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 56233
```

```
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 43125

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 45702

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 43125

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval 96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval 2.9

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : lowerlimit 3.1785
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
27.8  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 27.722  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
28.8  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 27.722  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 3.1785  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
4913  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4308.2  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
20100  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20052  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 20292

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : lowerlimit 0.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : upperlimit 63.31

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval 2.9
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 3.1725  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 3.1725  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
10221  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 9356.5  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
21836  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 9356.5  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
10962  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 9356.5  
  
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 15096  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 13309  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 13309

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval 96

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : upperlimit 95.47

Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval 20100

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : upperlimit 19988

Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 15096

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 13309

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 13309

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 20293

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval 30

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval 25

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : lowerlimit 32.665

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval 24
```

```
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 32.665  
  
Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 103  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
upperlimit 100.46  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval  
9  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 11.56  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
250  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 276.94  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1880  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1889  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1780  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1889  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 6392

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 6210.7

Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval 31643

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : upperlimit 30166

Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : lowerlimit 0.69

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : upperlimit 63.31

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval 4913
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4308.2
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
21836
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
10962
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 10272
```

```
Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1780
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1848.8
```

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 15171
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 48094
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 20292
```

```
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending
```

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 56233

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 45915

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : upperlimit 63.315

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval 2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : lowerlimit 2.7705

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : eval 21836

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : upperlimit 11017

Warning in gam.lo(data[["lo(P.Undergrad, span = 0.5, degree = 1)"]], z, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval 8124

Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : upperlimit 7453.2

```
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
lowerlimit 0.69
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval  
64
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
upperlimit 63.31
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
96
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 95.47
```

```
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval  
9
```

```
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 11.56
```

```
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
27.8  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 27.724  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
28.8  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 27.724  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2.7765  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
250  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 276.94  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
8124  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 7453.2  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 6392  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 6210.7
```

```
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
20100  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20052  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 15171  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, : eval  
31643  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
upperlimit 30166  
  
Warning in gam.lo(data[["lo(F.Undergrad, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 48094  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 20293  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 42926  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 40572  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 56233
```

```
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 40572

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 45702

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 40572

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval 24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : lowerlimit 24.625

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 103

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 100.46

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval 9

Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : lowerlimit 11.56
```

```
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
250  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 280.06  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
4913  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4307.9  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 26330  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 15171  
  
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 48094  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 20293  
  
Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 56233  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 45914  
  
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
  lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 2  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  lowerlimit 3.72  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 63  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  upperlimit 60.28  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 3  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  lowerlimit 3.72  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  lowerlimit 3.72  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 2  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  lowerlimit 3.72  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 1  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  lowerlimit 3.72  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
  extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 3

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 3.72

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 3

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 3.72

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 1

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 3.72

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 3

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
lowerlimit 3.72

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 64

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
upperlimit 60.28

Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :
extrapolation not allowed with blending

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
eval 8

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
lowerlimit 9.535

Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 2340  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 2009.5  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2.7705  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
4913  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4308.2  
  
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2492.4  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
lowerlimit 0.685
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 8  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
lowerlimit 9.55  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
eval 103  
  
Warning in gam.lo(data[["lo(PhD, span = 0.5, degree = 1)"]], z, w, span = 0.5, :  
upperlimit 100.45  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 1495  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 1306  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 2000  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 1306  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 2340  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : upperlimit 1306  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 1400
```

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 1306

Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval 27.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : upperlimit 27.724

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval 28.8

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : upperlimit 27.724

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval 2.5

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : lowerlimit 2.7765

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in lo.wam(x, z, wz, fit\$smooth, which, fit\$smooth.frame, bf.maxit, : lo.wam convergence not obtained in 30 iterations

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : eval 24

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : lowerlimit 24.625

Warning in gam.lo(data[["lo(Terminal, span = 0.5, degree = 1)"]], z, w, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval 2.9

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 3.1725  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval  
2.5  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 3.1725  
  
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1880  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1889  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, : eval  
1780  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 1889  
  
Warning in gam.lo(data[["lo(Room.Board, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
2340  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 2492.4  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :  
lo.wam convergence not obtained in 30 iterations  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, : eval 0
```

```
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
lowerlimit 0.685  
  
Warning in gam.lo(data[["lo(perc.alumni, span = 0.5, degree = 1)"]], z, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, : eval  
96  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 95.47  
  
Warning in gam.lo(data[["lo(Top10perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval  
9  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 12.565  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, : eval  
12  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
lowerlimit 12.565  
  
Warning in gam.lo(data[["lo(Top25perc, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : eval 35  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : lowerlimit 43.415  
  
Warning in gam.lo(data[["lo(Enroll, span = 0.5, degree = 1)"]], z, w, span =  
0.5, : extrapolation not allowed with blending  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
20100  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20052  
  
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 26330

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 15171

Warning in gam.lo(data[["lo(Accept, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 48094

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 20292

Warning in gam.lo(data[["lo(Apps, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 3365

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : lowerlimit 3523.2

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 3186

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : lowerlimit 3523.2

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 56233

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : upperlimit 45912

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : extrapolation not allowed with blending

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : eval 3480

Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span = 0.5, : lowerlimit 3523.2
```

```
Warning in gam.lo(data[["lo(Expend, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
Warning in lo.wam(x, z, wz, fit$smooth, which, fit$smooth.frame, bf.maxit, :
lo.wam convergence not obtained in 30 iterations
```

```
# Loess_model2 <- train(Grad.Rate ~ ., span = 0.3, data = train1, method = "gamLoess")
# summary(Loess_model)
loess_model
```

Generalized Additive Model using LOESS

623 samples
17 predictor

No pre-processing
Resampling: Bootstrapped (25 reps)
Summary of sample sizes: 623, 623, 623, 623, 623, 623, ...
Resampling results:

RMSE	Rsquared	MAE
15.68654	0.3417258	10.36953

Tuning parameter 'span' was held constant at a value of 0.5

Tuning
parameter 'degree' was held constant at a value of 1

```
## the span chosen by caret is 0.5.
prediction <- predict(loess_model, newdata = test1)
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : eval 96
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : lowerlimit 98.85
```

```
Warning in gam.lo(data[["lo(Books, span = 0.5, degree = 1)"]], z, w, span =
0.5, : extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, : eval
39.8
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
upperlimit 28.931
```

```
Warning in gam.lo(data[["lo(S.F.Ratio, span = 0.5, degree = 1)"]], z, w, :
- - - - -
```

```
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, : eval  
6800
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 4936.3
```

```
Warning in gam.lo(data[["lo(Personal, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, : eval  
21700
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
upperlimit 20189
```

```
Warning in gam.lo(data[["lo(Outstate, span = 0.5, degree = 1)"]], z, w, :  
extrapolation not allowed with blending
```

```
RMSE(prediction, test1$Grad.Rate)
```

```
[1] 12.59831
```

```
## the rest root mean squared error (RMSE) is 13.17063
```

10. Fit a Generalized Additive Spline regression model on the training set for predicting graduation rate using all the predictors. Do not specify a degree of freedom and let caret choose it. Report the degree of freedom chosen by caret. Predict graduation rate in the test dataset and report the test root mean squared error (RMSE).

```
gam_spline_model <- train(Grad.Rate ~ ., data = train1, method = "gamSpline")  
prediction <- predict(gam_spline_model, newdata = test1)  
RMSE(prediction, test1$Grad.Rate)
```

```
[1] 12.8421
```

```
## the rest root mean squared error (RMSE) is 12.41093
```